

left entirely disengaged, and Liberty by this means be given to Respiration to make both the Air alone, and the Air mix'd with the Tears, to pass continually through it.

In fine, the Action of these Fluids may be assisted by the Application of *Collyriums*, and by making frequent Injections into the *Puncta lacrymalia*; which, besides the common Effects that may be naturally expected from them, will contribute to prevent the Juice, that re-unites the Wound made in the Skin, from over-strengthening the Canal.

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## VI. Concerning the Cause of the General Trade-Winds : By Geo. Hadley, Esq; F. R. S.

I Think the Causes of the General Trade-Winds have not been fully explained by any of those who have wrote on that Subject, for want of more particularly and distinctly considering the Share the diurnal Motion of the Earth has in the Production of them : For although this has been mention'd by some amongst the Causes of those Winds, yet they have not proceeded to shew how it contributes to their Production ; or else have applied it to the ExPLICATION of these Phænomena, upon such Principles as will appear upon Examination not to be sufficient.

That the Action of the Sun is the original Cause of these Winds, I think all are agreed ; and that it does

does it by causing a greater Rarefaction of the Air in those Parts upon which its Rays falling perpendicularly, or nearly so, produce a greater Degree of Heat there than in other Places ; by which means the Air there becoming specifically lighter than the rest round about, the cooler Air will by its greater Density and Gravity, remove it out of its Place to succeed into it its self, and make it rise upwards. But it seems, this Rarefaction will have no other Effect than to cause the Air to rush in from all Parts into the Part where 'tis most rarefied, especially from the North and South, where the Air is coolest, and not more from the East than the West, as is commonly supposed : So that, setting aside the diurnal Motion of the Earth, the Tendency of the Air would be from every Side towards that Part where the Sun's Action is most intense at the Time, and so a N. W. Wind be produced in the Morning, and a N. E. in the Afternoon, by Turns, on this Side of the Parallel of the Sun's Declination, and a S. W. and S. E. on the other.

That the perpetual Motion of the Air towards the West, cannot be derived meerly from the Action of the Sun upon it, appears more evidently from this : If the Earth be supposed at Rest, that Motion of the Air will be communicated to the superficial Parts, and by little and little produce a Revolution of the Whole the same Way, except there be the same Quantity of Motion given the Air in a contrary Direction in other Parts at the same Time, which is hard to suppose. But if the Globe of the Earth had before a Revolution towards the East, this by the same means must be continually retard-

ed : And if this Motion of the Air be supposed to arise from any Action of the Parts of it on one another, the Consequence will be the same. For this reason it seems necessary to shew how these Phænomena of the Trade-Winds may be caused, without the Production of any real general Motion of the Air westwards. This will readily be done by taking in the Consideration of the diurnal Motion of the Earth : For, let us suppose the Air in every Part to keep an equal Pace with the Earth in its diurnal Motion ; in which Case there will be no relative Motion of the Surface of the Earth and Air, and consequently no Wind ; then by the Action of the Sun on the Parts about the Equator, and the Rarefaction of the Air proceeding therefrom, let the Air be drawn down thither from the N. and S. Parts. The Parallels are each of them bigger than the other, as they approach to the Equator, and the Equator is bigger than the Tropicks, nearly in the Proportion of 1000 to 917, and consequently their Difference in Circuit about 2083 Miles, and the Surface of the Earth at the Equator moves so much faster than the Surface of the Earth with its Air at the Tropicks. From which it follows, that the Air, as it moves from the Tropicks towards the Equator, having a less Velocity than the Parts of the Earth it arrives at, will have a relative Motion contrary to that of the diurnal Motion of the Earth in those Parts, which being combined with the Motion towards the Equator, a N. E. Wind will be produc'd on this Side of the Equator, and a S. E. on the other. These, as the Air comes nearer to the Equator, will become stronger, and more and more Easterly, and  
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be due East at the Equator itself, according to Experience, by reason of the Concourse of both Currents from the N. and S. where its Velocity will be at the rate of 2083 Miles in the Space of one Revolution of the Earth or Natural Day, and above 1 Mile and  $\frac{1}{3}$  in a Minute of Time; which, is greater than the Velocity of the Wind is supposed to be in the greatest Storm, which according to Dr. *Derham's* Observations, is not above 1 Mile in a Minute. But it is to be considered, that before the Air from the Tropicks can arrive at the Equator, it must have gained some Motion Eastward from the Surface of the Earth or Sea, whereby its relative Motion will be diminished, and in several successive Circulations, may be supposed to be reduced to the Strength it is found to be of.

Thus I think the N.E. Winds on this Side of the Equator, and the S.E. on the other Side, are fully accounted for. The same Principle as necessarily extends to the Production of the West Trade-Winds without the Tropicks; the Air rarefied by the Heat of the Sun about the Equatorial Parts, being removed to make room for the Air from the cooler Parts, must rise upwards from the Earth, and as it is a Fluid, will then spread itself abroad over the other Air, and so its Motion in the upper Regions must be to the N. and S. from the Equator. Being got up at a Distance from the Surface of the Earth, it will soon lose great Part of its Heat, and thereby acquire Density and Gravity sufficient to make it approach its Surface again, which may be supposed to be by that Time 'tis arrived at those Parts beyond the Tropicks where the westerly Winds are found.

found. Being suppos'd at first to have the Velocity of the Surface of the Earth at the Equator, it will have a greater Velocity than the Parts it now arrives at ; and thereby become a westerly Wind, with Strength proportionable to the Difference of Velocity, which in several Revolutions will be reduced to a certain Degree, as is said before, of the Easterly Winds, at the Equator : And thus the Air will continue to circulate, and gain and lose Velocity by Turns from the Surface of the Earth or Sea, as it approaches to, or recedes from the Equator. I do not think it necessary to apply these Principles to solve the Phænomena of the Variations of these Winds at different Times of the Year, and different Parts of the Earth ; and to do it would draw this Paper into greater Length than I propose. From what has been said it follows :

*First,* That without the Assistance of the diurnal Motion of the Earth, Navigation, especially Easterly and Westerly, would be very tedious, and to make the whole Circuit of the Earth perhaps impracticable.

*Secondly,* That the N. E. and S. E. Winds within the Tropicks must be compensated by as much N.W. and S. W. in other Parts, and generally all Winds from any one Quarter must be compensated by a contrary Wind some where or other ; otherwise some Change must be produced in the Motion of the Earth round its Axis.